7.0 Airport Demand Capacity

7.0 AIRPORT DEMAND CAPACITY

The purpose of this section is to determine the capacity of the Airport based upon the previously developed aviation forecasts. An analysis of the aviation demand forecasts indicates an increase in all segments of activity. To accommodate these increases, it is anticipated that Airport improvements and facility expansion will be necessary to meet future aviation needs.

The methodology used begins with an examination of the Airport system's major components: airfield, building facilities, and airspace. Each of these components must be balanced to achieve system optimization. By study design, the most constraining system component is identified and examined in conjunction with the remaining components to establish an overall balanced system potential.

7.1 AIRSIDE CAPACITY

The major components of the airfield system to be taken into consideration when determining airside capacity include runway configuration, runway length, runway exit frequency and exit location. Additionally, the capacity of a given system is further affected by operational characteristics such as fleet mix, climatology, and air traffic control procedures. Each of these components has been examined as part of the airside capacity analysis.

7.1.1 Fleet Mix

Aircraft fleet mix is the relative percentage of operations conducted by each of the four classes of aircraft (A, B, C, and D). Table 7-1 identifies the physical aspects of the four aircraft classes. The aircraft fleet mix will influence the overall capacity of an airport. For example, large aircraft, which primarily operate under instrument flight rules, require more time on the runway (runway occupancy time) than smaller aircraft. Although larger aircraft fly at higher airspeeds, smaller aircraft can be more closely spaced and require less

Table 7-1. Aircraft Classification System--Avi Suquilla Airport

Aircraft Classification	Description
Class A	Small single-engine aircraft weighing 12,500 pounds* or less.
Class B	Small twin-engine aircraft weighing 12,500 pounds or less.
Class C	Large aircraft weighing more than 12,500 pounds but less than 300,000 pounds.
Class D	Heavy aircraft weighing more than 300,000 pounds.†

* Weights refer to maximum certified takeoff weight.
† No Class D aircraft are projected to use Avi Suquilla Airport.

Source: FAA, 1984.

runway, allowing them to depart the runway system sooner, both on takeoff and landing. Theoretically, an airport will experience an overall lower capacity as the ratio of large aircraft operations to total operations increases, and vice versa.

7.1.2 Climatology

Information on meteorological conditions pertaining specifically to Avi Suquilla Airport is not officially recorded by the National Climatic Center, Asheville, North Carolina. Therefore, weather recorded at Yuma Airport, Yuma Arizona, located 103 miles south-southwest of Avi Suquilla, and Luke AFB, located 106 miles east southeast of Avi Suquilla, was used since it most closely represents the weather experienced at Avi Suquilla. The information was derived from observations covering a period of 29 years, from 1949 through 1978. An analysis of the ceiling and visibility data was performed to calculate the percentage of flying weather for three conditions:

1. VFR (at or above 1,000-foot ceiling and 3-mile visibility),
2. IFR (670* to 1,000-foot ceiling and/or 1- to 3-mile visibility),
3. Below Minimums (below 670-foot* ceiling and/or below 1-mile visibility).

* The minimum height above touchdown allowed for a circling approach to Avi Suquilla Airport for aircraft in Approach Category A, B, and C, using a Blythe or Needles Airport altimeter setting. The aircraft approach categories are:

Category A--Speed less than 91 knots;
Category B--Speed 91 knots or more but less than 121 knots;
Category C--Speed 121 knots or more but less than 141 knots;
Category D--Speed 141 knots or more but less than 166 knots; and
Category E--Speed 166 knots or more.

Source: FAA Advisory Circular 150/5300-4B.

From the observations recorded under each of the conditions shown in Table 7-2, it was determined that, using existing approach aids and currently authorized approach minimums, the Airport operates under VFR conditions approximately 99.6 percent of the year, with IFR conditions and below minimums occurring 0.4 and 0.2 percent of the year, respectively. With the installation of improved approach aids located on the Airport, approach minimums can be lowered, allowing aircraft to utilize the Airport a greater percentage of the year. For capacity calculations, by the year 2005, VFR conditions will remain unchanged.

Wind direction and speed determine the desired alignment and configuration of the runway system. From the information supplied by NOAA's National Climatic Center covering a 29-year recording period, two wind roses were developed (Figures 7-1 and 7-2) for Avi Suquilla Airport. These wind roses are representative of wind direction and velocity for IFR and all-weather (both VFR and IFR) operations.

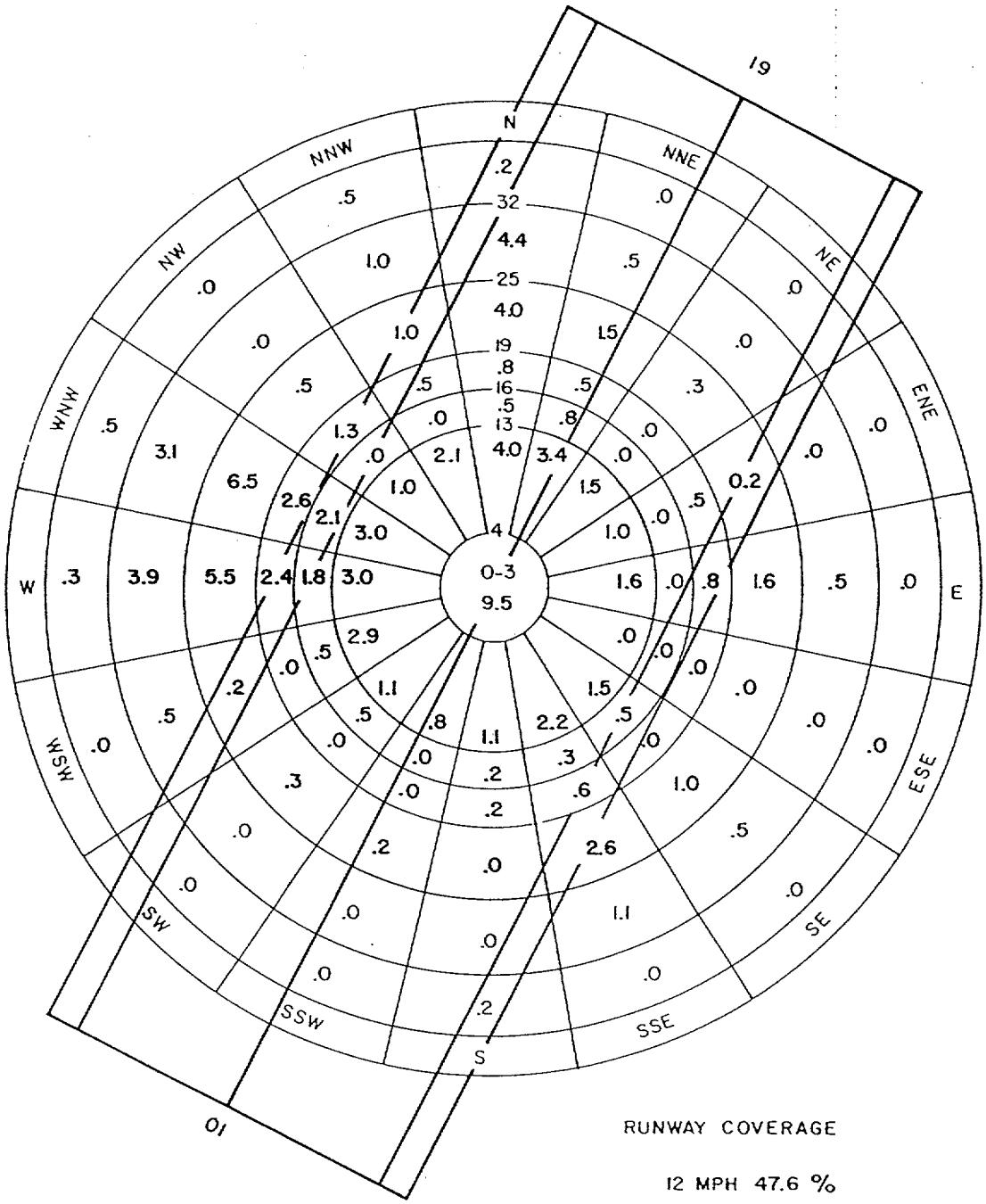
Wind coverage is that percentage of time for which operations are considered safe due to acceptable crosswind components. The acceptable wind coverage for an airport is 95 percent or more, based on the total hours of weather observations. Where a single runway cannot be oriented to provide 95-percent coverage, one or more additional runways will be required to raise the coverage to that value. In general, for planning purposes, large aircraft can be adequately controlled with crosswind components up to 15 miles per hour (13 knots), while planning for small light aircraft should use a 12 miles per hour (10.5 knots) crosswind component. For both the all-weather and IFR wind roses for Avi Suquilla Airport, single runway coverage for the two crosswind components have been computed and are shown in Table 7-3. The combined coverage for

Table 7-2. Percentage of Weather Conditions by Category and Month--Avi Suquilla Airport*

Month	VFR %	IFR %	Below† Minimums %
January	89.8	0.7	0.5
February	99.2	0.6	0.2
March	99.5	0.5	0.4
April	100.0	0.0	0.0
May	99.9	0.1	0.0
June	100.0	0.0	0.0
July	99.7	0.3	0.1
August	99.8	0.2	0.1
September	99.8	0.2	0.1
October	99.9	0.1	0.1
November	99.6	0.4	0.4
December	98.6	1.4	0.9
ANNUAL	99.6	0.4	0.2

* Percent of all hours during the month indicated.
† Based upon current minimums of 714 feet above touchdown for aircraft in Approach Categories A and B, using a Blythe or Needles Airport altimeter setting. These values are included in the overall IFR percentage column.

Sources: NOAA National Climatic Center, Asheville, North Carolina, 1944-1946, 1952-1967.
RS&H, 1985.



RUNWAY COVERAGE

12 MPH 47.6 %

15 MPH 58.8 %

STATION: YUMA ARIZONA
PERIOD OF RECORD: 1949-1978
OBSERVATIONS: 321
NOTE: SPEEDS ARE IN MILES PER HOUR

Figure 7-1
IFR WIND ROSE

SOURCE: NATIONAL CLIMATIC CENTER, 1985; RS&H, 1985.

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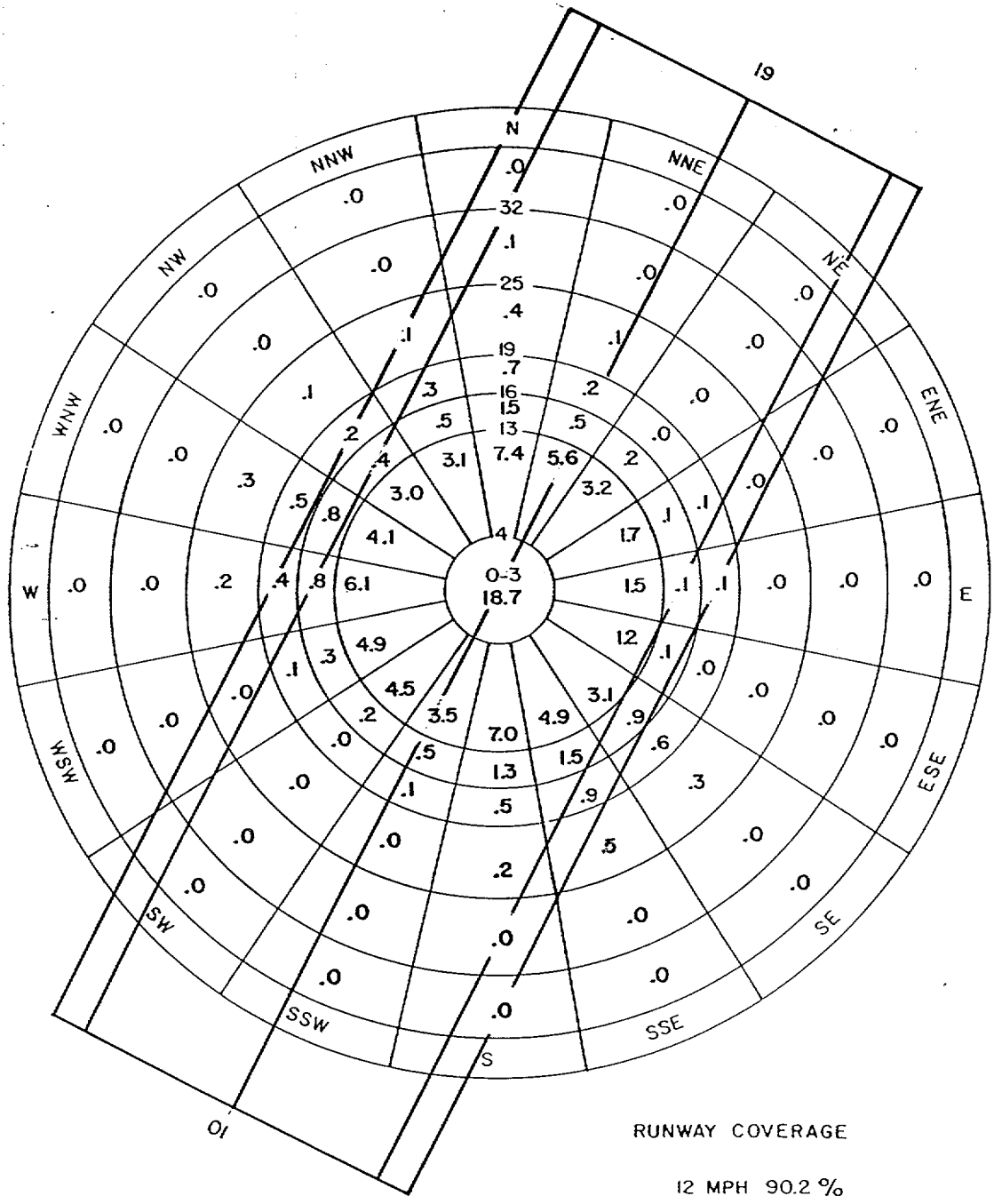
UPDATE



RUNWAY COVERAGE

12 MPH 90.2 %

15 MPH 96.3 %

STATION: YUMA ARIZONA
PERIOD OF RECORD: 1949-1978
OBSERVATIONS: 87,923
NOTE: SPEEDS ARE IN MILES PER HOUR

Figure 7-2.
ALL WEATHER WIND ROSE

SOURCE: NATIONAL CLIMATIC CENTER, 1985; RS&H, 1985.

AVI SUQUILLA AIRPORT
MASTER PLAN
UPDATE

Table 7-3. Wind Coverage by Direction and Crosswind Component

	Runway 01/19	
	15 MPH	12 MPH
All-weather percent	96.3	90.2
IFR Percent	63.3	50.9

Sources: NOAA National Climatic Center, North Carolina, 1985.
RS&H, 1985.

both the all-weather and IFR wind roses indicates that the existing runway system provides adequate coverage for all aircraft. As shown in Table 7-3 and Figures 7-1 and 7-2, Runway 01/19 provides adequate coverage to meet the 95-percent planning requirement for all-weather conditions; however, under IFR conditions the runway does not meet the 95-percent criteria for large or small aircraft.

By examining the all-weather values for single directional runway coverage, it was determined that approximately 57 percent of the time the prevailing winds at the Airport are from a southerly direction, and the remaining 43 percent of the time the winds are from a northerly direction. However, during IFR conditions, approximately 63 percent of the time the wind is from the north, with the remaining 37 percent of the time having winds from an southerly direction. The percentage of calm winds (0-3 mph) in which any runway could be utilized is 18.7 percent of the time under all-weather conditions and 9.5 percent of the time under IFR conditions.

7.1.3 Existing Airfield Capacity

This section examines the computed hourly capacities for both VFR and IFR conditions, as well as the Annual Service Volume (ASV) for the existing runway at Avi Suquilla Airport.

Study Parameters--To derive the hourly capacity for an existing runway, the following input is required:

1. Weather--As was previously determined, the all-weather VFR wind coverage exceeds the required 95-percent coverage. Visual (VFR) and instrument (IFR and below minimums) conditions occur 99.6 and 0.4 percent of the year respectively, with below minimums occurring 0.2 percent of the year.

2. Mix Index--The mix index is a mathematical expression used in the capacity calculations to assess the degree of impact of large aircraft on an airfield system. Generally, an airport which experiences a relatively high percentage of operations by Class C and D aircraft would have a lower theoretical hourly capacity and ASV. The expression for the mix index is the percentage of Class C (large) aircraft operations plus three times the percentage of Class D (heavy) aircraft operations, or % (C+3D). Based on the estimated 1984 air traffic activity at Avi Suquilla Airport, it was determined that Class A and B (small aircraft) would represent 99.9 percent of the operations at the Airport and Class C aircraft would comprise the remaining 0.1 percent. Consequently, for capacity calculations, the existing mix index for the Airport = % [0.1 + 3(0)] = 0.1.
3. Percent Arrivals--The level of arrivals experienced at the Airport has an effect on capacity since arriving aircraft are usually given priority over departing aircraft, and arriving aircraft typically require more time in the total runway component (approach plus roll out) than departing aircraft. Consequently, the methodology used here provides different hourly capacity values for three levels of arrivals (expressed as a percentage of total operations). For general planning purposes, 50-percent arrivals is usually applied to determine the overall capability of the airfield system. However, for comparative purposes, the 40-, 50-, and 60-percent levels of arrivals were used in the capacity calculations for Avi Suquilla Airport.
4. Percent Touch-and-Go--This variable represents the ratio of touch-and-go operations to total operations. Touch-and-go operations are counted as both a landing and a takeoff, but require more runway occupancy time than either an individual takeoff or landing. It was determined from conversations with users of the Airport that less than 10 percent of total

operations are touch-and-go traffic. Only slight fluctuations in touch-and-go activity are anticipated due to the steady growth in local operations as projected in the approved forecasts.

5. Exit Taxiways--Based on the mix index and runway configuration, the optimum number and location of runway exits can be determined within specified distances from the landing threshold. The number of runway exits was determined to establish the VFR and IFR hourly capacities. A runway with optimally located exit taxiways would have a higher VFR and IFR hourly capacity. In determining the capacity for Avi Suquilla Airport, the hourly capacity was calculated based on a runway exit factor of 1.

6. IFR Hourly Capacity--For purposes of this analysis, the numerical figures for IFR Hourly Capacity will remain at zero, since the VOR circling approach presently used at the airport is not considered an instrument approach.

Taking each of the foregoing variables into consideration, the VFR and IFR hourly capacities and the ASV for the existing runway configuration were calculated. These values are presented in the following analysis.

Capacity Analysis--Based on the meteorological data previously examined, the existing system can operate at least 96 percent of the year without experiencing adverse crosswind conditions. By multiplying the base hourly capacity (determined by the mix index and percent arrivals) by the touch-and-go factor and the runway exit factor, the adjusted VFR and IFR hourly capacities for the existing runways are as follows:

Percent Arrivals	Existing Hourly Capacity	
	VFR	IFR
40	104.31	0.0
50	98.38	0.0
60	90.55	0.0

To determine the ASV for the total runway system, the following formula is applied:

Weighted hourly capacity x daily ratio x hourly ratio = ASV

The weighted hourly capacity is the combined VFR and IFR hourly capacity adjusted for the percentage of time the operating condition (IFR or VFR) occurs annually. The daily and hourly ratios, computed to be 304 and 7.88 respectively, are measures which determine the ratio of annual operations to average daily operations during the peak month, and the ratio of average daily operations to average peak-hour operations of the peak month. The following computation produces the ASV, by percentage of arrivals, for the total runway system:

- 40-Percent Arrivals--Weighted hourly capacity =

$$\frac{(0.92 \times 104.31 \times 1) + (0.08 \times 0.0 \times 4)}{(0.92 \times 1) + (0.08 \times 4)} = 77.39$$

Annual Service Volume = 77.39 x 304 x 7.88
ASV = 185,392

- 50-Percent Arrivals

$$\frac{(0.92 \times 98.38 \times 1) + (0.08 \times 0.0 \times 4)}{(0.92 \times 1) + (0.08 \times 4)} = 72.99$$

Annual Service Volume = 72.99 x 304 x 7.88
ASV = 174,852

- 60-Percent Arrivals

$$\frac{(0.92 \times 90.55 \times 1) + (0.08 \times 0.0 \times 4)}{(0.92 \times 1) + (0.08 \times 4)} = 67.18$$

Annual Service Volume = 67.18 x 304 x 7.88

ASV = 160,936

Using the 50-percent arrivals planning criteria, the theoretical capacity of the existing runway system is as follows:

- VFR Hourly Capacity = 98.38 (98) movements
- IFR Hourly Capacity = 0.0 (0) movements
- ASV = 174,852 (175,000) operations

7.1.4 Future Capacity of Existing Airfield

The procedure for determining airfield capacity just described determines the ASV for the existing runway use configuration under existing conditions. As was determined in the forecast section, the airfield is not expected to reach capacity during the planning period, and Table 7-4 illustrates that airfield capacity will remain essentially the same throughout the year 2005. Those airfield improvements required to accommodate the projected increase in based aircraft will be addressed in the Facility Requirements section of this report.

7.2 LANDSIDE CAPACITY

Based on field surveys and methods prescribed in Advisory Circulars 150/5300-4B and 150/5300-12, it is estimated that the existing general aviation aircraft parking area is operating at approximately 75 to 80 percent of efficient capacity. Experience shows that, through adequate planning, continuity of fleet mix, and careful consideration of the open area relative to other landside facilities such as hangars, terminal buildings, etc., approximately 13 large aircraft (corporate twin-engine aircraft) or 16 small aircraft (single engine) can be accommodated on an acre of apron space.

As a result, the current level of landside utilization is compatible with its level of demand. As based aircraft increase over the forecast period, coupled with increases in itinerant traffic, the Airport's apron

Table 7-4. Capacity Analysis - Avi Suquilla Airport

Year	Percent Arrivals	Mix Index % (C+3D)	VFR Hourly Capacity	IFR Hourly Capacity	ASV
1985	40	0.1	104.31	0.0	185,392
	50	0.1	98.38	0.0	174,852
	60	0.1	90.55	0.0	160,936
2005	40	0.1	104.31	0.0	185,392
	50	0.1	98.38	0.0	174,852
	60	0.1	90.55	0.0	160,936

Sources: FAA Advisory Circular 150/5060-5, Airport Capacity and Delay, 1983.
RS&H, 1985.

and hangar area will require expansion to meet its projected 20-year demand. The specific requirements are addressed under Landside Requirements.

7.3 AIRSPACE CAPACITY

The airspace within 20 nautical miles of the Airport was analyzed to identify factors which may impact aircraft operations. One federal airway passes close to Avi Suquilla Airport: Victor 135 located west of the airport in a north-south fashion as described by the Blythe, Parker and Needles VORTACs. Victor 135 has a designated ceiling of 9,000 feet msl, south of Parker VORTAC, and 10,000 feet msl between the Parker and Needles VORTACs. Four MOAs are located near Parker: Quail MOA, less than 1 mile south of Avi Suquilla Airport; Turtle MOA, approximately 10 miles north-northwest at the nearest point; Gladden 1 Alpha MOA, 16 miles east; and Bagdad 1 MOA, approximately 14 miles northeast of the Airport. However, all four MOAs begin at 7,000 AGL or higher, and throughout the forecast period, it is anticipated that airspace capacity, both VFR and IFR, will not be a factor in relation to Avi Suquilla Airport.